What is Claimed Is:

1. A method of manufacturing a reflection type liquid crystal display device, comprising steps of

(a) forming a distribution of deformation characteristics in a thickness direction or a plane direction of a resin layer; and

(b) forming undulation at the surface of the photo-sensitive resin layer

2. A method of manufacturing a reflection type liquid crystal display device, comprising steps of

(a) irradiating light having exposure energy on a surface of a photo-sensitive resin layer having a predetermined film thickness, to form a distribution of thermal deformation characteristics in a thickness direction or a plane direction of the photo-sensitive resin layer; and

(b) performing heat treatment thereafter to form undulation at the surface of the photo-sensitive resin layer.

3. A method of manufacturing a reflection type liquid crystal display device, comprising steps of

(a) soaking a photo-sensitive resin layer having a predetermined film thickness in a chemical liquid having any of an acid, an alkali solution, a quaternary ammonium salt solution, and HMDS, to form distribution of thermal deformation characteristics in a thickness direction or a plane direction of the photo-sensitive resin layer; and

(b) performing heat treatment thereafter to form undulation at the surface of the photo-sensitive resin layer.

~~4. The method of forming a reflection type liquid crystal display device according to claim 2, wherein the light having said exposure energy in said process (a) is far-ultraviolet radiation.~~

5. The method of forming a reflection type liquid crystal display device according to Claim 2, wherein the light having said exposure energy in said process (a) is irradiated on the entire surface of the photo-sensitive resin layer to alter the surface, so as to form the distribution of the thermal deformation characteristics in the thickness direction of the photo-sensitive resin layer.

6. The method of forming a reflection type liquid crystal display device according to Claim 2, wherein the light having said exposure energy in said process (a) is irradiated on a part of the area of the surface of the photo-sensitive resin layer to alter the surface, so as to form the distribution of the thermal deformation characteristics in the plane direction of the photo-sensitive resin layer.

7. The method of forming a reflection type liquid crystal display device according to Claim 2 or Claim 3, further comprising a step of forming separation lines to said

photo-sensitive resin layer where the film thickness thereof is smaller.

8. A method of manufacturing a reflection type liquid crystal display device, comprising steps of

(a) forming a photo-sensitive resin layer having a predetermined film thickness on a substrate having a transistor formed on the surface thereof;

(b) forming a contact hole to an electrode of said transistor by a photo-lithography process for partially exposing and developing said photo-sensitive resin layer;

(c) post baking to heat said photo-sensitive resin layer to a first temperature;

(d) irradiating light having exposure energy on the surface of said photo-sensitive resin layer, to form distribution of thermal deformation characteristics in a thickness direction or a plane direction of the photo-sensitive resin layer; and then

(e) final baking to perform heat treatment at a second temperature higher than said first temperature, to form undulation at the surface of said photo-sensitive resin layer.

9. The method of forming a reflection type liquid crystal display device according to Claim 8, further comprising a step of forming a pixel electrode which is connected to the electrode of said transistor via said contact hole on said photo-sensitive resin layer after said

step (e).

10. The method of forming a reflection type liquid crystal display device according to Claim 8, further comprising a step of exposing or half-exposing and developing said photo-sensitive resin layer with a predetermined pattern, to form separation lines for separating said photo-sensitive resin layer before said step (c).

11. The method of forming a reflection type liquid crystal display device according to Claim 8, wherein the average inclination angles of said undulation is set to 0° - 15° by controlling the film thickness of the photo-sensitive resin layer in said step (a), time and temperature of post-bake in said step (c), and irradiation energy quantity in said step (d).

12. The method of forming a reflection type liquid crystal display device according to Claim 11, further comprising a step of forming an alignment film and forming a liquid crystal layer between a substrate at a display side and the alignment film after the step of forming said pixel electrode.

13. A reflection type liquid crystal display device comprising a substrate on which a liquid crystal layer is formed, wherein inclination angles of an undulation for

reflection formed at the liquid crystal layer side of said substrate are at least in a 0° - 20° range, and an existence probability of said inclination angle becomes a peak in a 15° - 19° range.

14. The reflection type liquid crystal display device according to Claim 13, wherein a plane pattern of said undulation for reflection includes circular, polygonal, stripes or a combination thereof.

15. A reflection type liquid crystal display device comprising a substrate on which a liquid crystal layer is formed, wherein inclination angle of an undulation for reflection formed at the liquid crystal layer side of said substrate are distributed such that an existence probability thereof has one peak along a first direction, and the existence probability thereof has two peaks along a second direction which is different from said first direction.

16. The reflection type liquid crystal display device according to Claim 15, wherein a display face of said reflection type liquid crystal display device is disposed inclined, where said first direction is a horizontal direction and said second direction is a vertical direction.

17. The reflection type liquid crystal display device according to Claim 15 or Claim 16, wherein the existence

probability along said first direction has one peak in a 15° - 19° range, and the existence probability along said second direction has a peak in a 15° - 19° range and 0° - 14° range respectively.

18. The reflection type liquid crystal display device according to Claim 15 or Claim 16, wherein the existence probability along said second direction has a peak in a first angle range and a second angle range in a first area, and the existence probability along said second direction has a peak in said first angle range and a third angle range in a second area in each pixel area of the display face.

19. The reflection type liquid crystal display device according to any of Claim 13 to Claim 16, further comprising a display side substrate which sandwiches said liquid crystal layer with said substrate and a polarizer formed at the display side of said display side substrate, wherein said liquid crystal layer is driven in field effect double refraction mode.

20. A reflection type liquid crystal display device comprising an undulation for reflection on a substrate, wherein a first convex part having a first directivity and a first scattering characteristics for reflected light, and a second convex part having a second directivity which is weaker than said first directivity and a second scattering

characteristics which is stronger than said first scattering characteristics for said reflected light coexist at random in a single pixel area.

21. A reflection type liquid crystal display device comprising

an undulation for reflection on a substrate,

wherein said undulation is formed by a photo-sensitive resin layer, first circular patterns are arranged with a first distance or longer apart from each other, and second circular patterns, which are smaller than said first circular pattern, are arranged with a distance less than said first distance from said first circular pattern.

22. A reflection type liquid crystal display device comprising

an undulation for reflection on a substrate,

wherein said undulation is formed by a photo-sensitive resin film and a plurality of polygon patterns are arranged so that the sides of adjacent polygons are parallel to each other.

23. A reflection type liquid crystal display device, comprising

a reflection type liquid crystal display panel; and

a front light, disposed on said reflection type liquid crystal display panel, which includes a light guiding plate,

a light source disposed at an edge of said light guiding plate, and light scattering means which exhibits light scattering characteristics for a light which conducts said light guiding plate when said light source is on and decreases said light scattering characteristics when said light source is not on.

24. The reflection type liquid crystal display device according to Claim 23, wherein said light guiding plate and light scattering means has a liquid crystal panel which comprises a pair of transparent substrates, transparent electrodes formed on opposite faces of the transparent substrates, and liquid crystal layer formed between said transparent substrate pair, and said liquid crystal layer exhibits light scattering characteristics according to the electric field to be applied between said transparent electrodes.

25. The reflection type liquid crystal display device according to Claim 24, wherein said light source is disposed on the side face of the transparent substrate at the display side of said pair of transparent substrates, and said liquid crystal layer is disposed between the transparent substrate at the display side and the transparent substrate at said reflection type liquid crystal display panel side.

26. The reflection type liquid crystal display device

according to Claim 23, wherein said light scattering means has a liquid crystal panel further comprising a pair of transparent substrates, transparent electrodes formed on the opposite faces of the transparent substrates, and a liquid crystal layer formed between said transparent substrate pair, and said liquid crystal layer exhibits light scattering characteristics according to the electric field to be applied between said transparent electrodes, and said pair of transparent substrates are glued to said light guiding plate.

27. The reflection type liquid crystal display device according to any one of Claim 24 to Claim 26, wherein a direction of refractive index anisotropy of said liquid crystal layer changes according to the electric field to be applied, a transparent prism-shaped undulated layer is disposed between one of said transparent substrates and said liquid crystal layer, and a refractive index of said undulated layer matches with one refractive index of the liquid crystal layer.

28. The reflection type liquid crystal display device according to any one of Claim 24 to Claim 26, wherein said transparent electrodes are separated into a plurality of parts and voltage is selectively applied to a separated transparent electrode, so as to adjust the degree of light scattering of said liquid crystal layer.

29. The reflection type liquid crystal display device according to any one of Claim 24 to Claim 26, wherein said liquid crystal layer is one of a liquid crystal material using a dynamic scattering effect, a liquid crystal material using a phase transition effect between a cholesteric phase and a nematic phase, a first polymer dispersion type liquid crystal material having liquid crystal grains having refractive index anisotropy in the polymer, and a second polymer dispersion type liquid crystal material having liquid crystal grains having refractive index anisotropy in a polymer having refractive index anisotropy.

30. A method of manufacturing a reflection type liquid crystal display device where a reflection layer is formed on a substrate via a resin layer, comprising steps of:

distributing thermal deformation characteristics at least in one direction of a thickness direction and a plane direction of said resin layer;

performing heat treatment to said resin layer to form undulation at a surface of said resin layer; and

forming said reflection layer with a surface shape reflecting said undulation of said resin layer on said resin layer,

wherein the distribution of thermal deformation characteristics of said resin layer is adjusted and said undulation shape of said resin layer is controlled to be a desired shape.

31. The method of manufacturing a reflection type liquid crystal display device according to Claim 30, wherein said undulation of said resin layer is a wrinkled shape.

32. The method of manufacturing a reflection type liquid crystal display device according to Claim 30 or Claim 31, wherein the exposure time is adjusted to expose said resin layer using an arbitrary mask pattern when the distribution of the thermal deformation characteristics of said resin layer is adjusted, so that the film thickness of said resin layer is distributed and said undulation shape of said resin layer is controlled.

33. The method of manufacturing a reflection type liquid crystal display device according to any one of Claims 30 to 32, wherein when at least one type of composing elements to be disposed on the surface of said substrate is formed, the distribution of thermal deformation characteristics of said resin layer is adjusted and said undulation shape of said resin layer is controlled using said composing elements by setting at least one of number, shape and arrangement of said composing elements to a desired value.

34. A method of manufacturing a reflection type liquid crystal display device comprising a reflection layer formed on a substrate via a resin layer, comprising:

a first step of distributing thermal deformation characteristics in at least one direction of a thickness direction and a plane direction of said resin layer;

a second step of forming undulation at a surface of said resin layer by performing heat treatment to said resin layer; and

a third step of forming said reflection layer, having a surface shape reflecting said undulation of said resin layer, on said resin layer,

wherein said undulation shapes of said resin layer in said third step are controlled by creating a part which thermal deformation characteristics are different from said resin in said resin layer.

~~35. A method of manufacturing a reflection type liquid~~ crystal display device according to Claim 34, ~~wherein said undulation of said resin layer are formed such that the ridge line shape thereof becomes at least one of a linear, curved, looped and branched shape.~~

~~36. The method of manufacturing a reflection type~~ liquid crystal display device according to Claim 34 or Claim 35, wherein said part is formed by forming a resin layer having a predetermined shape with different thermal deformation characteristics in said resin layer.

~~37. The method of manufacturing a reflection type~~

liquid crystal display device according to Claim 34 or Claim 35, wherein said part having different thermal deformation characteristics is formed by performing partial processing on said resin layer.

38. A method of manufacturing a reflection type liquid crystal display device comprising a reflection layer formed on a substrate via a resin layer, comprising:

a first step of distributing thermal deformation characteristics in said resin layer;

a second step of forming undulation at a surface of said resin layer by performing heat treatment to said resin layer; and

a third step of forming said reflection layer having a surface shape reflecting said undulation of said resin layer on said resin layer,

wherein in said first step, shrinkage factors are distributed in a thickness direction of said resin layer by irradiating light with a predetermined exposure energy on the surface of said resin layer, and said undulation shape of said resin layer formed by said third step is controlled.

39. The method of manufacturing a reflection type liquid crystal display device according to Claim 38, wherein said predetermined exposure energy has a value of 1000mJ/cm^2 or more.

40. The method of manufacturing a reflection type liquid crystal display device according to Claim 38 or Claim 39, further comprising a fourth step of performing heat treatment to said resin layer before said first step.

41. The method of manufacturing a reflection type liquid crystal display device according to any one of Claim 38 to Claim 40, wherein said resin layer is patterned before said first step.

42. The method of manufacturing a reflection type liquid crystal display device according to any one of Claim 38 to Claim 41, wherein an undulation pattern is formed on said substrate before said first step.

43. A reflection type liquid crystal display device comprising

a substrate;

a resin layer which is formed on said substrate and has undulation controlled to configure an area having different distribution at least one direction of a thickness direction and a plane direction; and

a reflection layer which is formed on said resin layer and has a surface shape reflecting said undulation of said resin layer.

44. The reflection type liquid crystal display device

according to Claim 43, wherein said undulation of said resin layer has a wrinkled shape.

45. The reflection type liquid crystal display device according to Claim 43 or Claim 44, wherein at least one of number, shape and arrangement of comprising elements disposed on the surface of said substrate is set to a desired value and an area having a different distribution of said undulation is formed corresponding to said setting.

46. The reflection type liquid crystal display device according to Claim 45, wherein said substrate is a thin film transistor (TFT) formed substrate and said composing elements to be used for controlling said undulation shape of said resin layer is one or more of a metal layer, insulation layer, and semiconductor layer formed on said TFT substrate.

47. The reflection type liquid crystal display device according to Claim 45, wherein said substrate is a thin film transistor (TFT) formed substrate and said composing element used for controlling said undulation shape of said resin layer is a contact hole connecting an electrode on said substrate and said reflection layer.

48. The reflection type liquid crystal display device according to any one of Claim 45 to Claim 47, wherein the average inclination angle of said undulation of said resin

layer is a value between 8° and 13°.

49. A reflection type liquid crystal display device comprising:

a substrate;

a resin layer formed on said substrate which comprises a part which thermal deformation characteristics are different from said resin, and undulation formed in at least one direction of a thickness direction and an in-plane direction controlled by the thermal deformation characteristics of said resin and said part; and

a reflection layer which is formed on said resin layer and has a surface shape reflecting said undulation of said resin layer.

50. The reflection type liquid crystal display device according to Claim 49, wherein said undulation of said resin layer is formed such that the ridge line shape thereof becomes at least one of a linear, curved, looped and branched shape.

51. The reflection type liquid crystal display device according to Claim 49 or Claim 50, wherein said part is comprised of particles having different thermal deformation characteristics in the resin layer.

52. The reflection type liquid crystal display device

according to Claim 49 or Claim 50, wherein said part is comprised of another resin layer having different thermal deformation characteristics layered in said resin layer.

53. The reflection type liquid crystal display device according to Claim 49 or Claim 50, wherein said part is comprised of another resin layer having different thermal deformation characteristics formed into a predetermined shape in said resin layer.

54. A reflection type liquid crystal display device comprising:

a substrate;

a resin layer formed on said substrate, and having undulation at a surface thereof; and

a reflection layer which is formed on said resin layer and has a surface shape reflecting said undulation of said resin layer,

wherein an irradiation of light with a predetermined exposure energy to the surface of said resin layer forms distribution of shrinkage factors in a thickness direction of said resin layer, and said undulation of said resin layer is formed corresponding to said distribution of said shrinkage factors.

55. A reflection type liquid crystal display device comprising:

a substrate;

a resin layer formed on said substrate, and having undulation at a surface thereof; and

a reflection layer which is formed on said resin layer and has a surface shape reflecting said undulation of said resin layer,

wherein said reflection layer has a light absorption layer, where the light absorption characteristics depends on azimuth, on the front face thereof, where a reflected light scattering width in the incident plane when parallel lights are entered depends on the azimuth of the incident light, and the azimuth when said reflected light scattering width is the maximum and the azimuth when the light absorption of said light absorption layer is the maximum or the minimum roughly match.

56. The reflection type liquid crystal display device according to Claim 55, wherein said light absorption layer is comprised of a guest-host liquid crystal, and alignment processing has been performed to an azimuth where said reflected light scattering width is the maximum.

57. The reflection type liquid crystal display device according to Claim 55, wherein a liquid crystal layer and one or more returdation layer are disposed between said reflection layer and said light absorption layer.

58. The reflection type liquid crystal display device according to any one of Claim 55 to Claim 57, wherein said undulation shape of said reflection layer includes one of a rectangle, ellipse, trapezoid, cocoon-shape and wrinkle shape, or a combination thereof.

59. A reflection type liquid crystal display device comprising:

a light guiding plate which comprises a plurality of convex parts which includes a first inclined face which rises from a flat plane at a first angle or is in parallel with the flat plane, and a second inclined face which is formed adjacent to said first inclined face and falls at a second angle which is larger than said first angle;

an illumination device which has a light source disposed on a side face of said light guiding plate;

a reflection type liquid crystal panel which is disposed at the bottom of said light guiding plate facing the light guiding plate;

a polarizer which is disposed between said light guiding plate and the liquid crystal layer of said reflection type liquid crystal panel; and

a low refractive index layer which is disposed between said polarizer and said light guiding plate and has a refractive index lower than said light guiding plate,

wherein said light guiding plate, said low refractive index layer, said polarizer and said reflection liquid

crystal panel are disposed without sandwiching a gap respectively.

60. A reflection type liquid crystal display device comprising:

a light guiding plate which comprises a plurality of convex parts which includes a first inclined face which rises from a flat plane at a first angle or is in parallel with the flat plane, and a second inclined face which is formed adjacent to said first inclined face and falls at a second angle which is larger than said first angle;

an illumination device which has a light source disposed on a side face of said light guiding plate;

a reflection type liquid crystal panel which is disposed at the bottom of said guiding plate facing the light guiding plate;

a polarizer which is disposed between said light guiding plate and the liquid crystal layer of said reflection type liquid crystal panel; and

a low refractive index layer which is disposed between said polarizer and said light guiding plate and has a refractive index lower than said light guiding plate,

wherein said polarizer and said reflection liquid crystal panel are disposed sandwiching a gap, and said light guiding plate, said low refractive index layer and said polarizer are disposed without sandwiching a gap respectively.

61. The reflection type liquid crystal display device according to Claim 59 or Claim 60, wherein said polarizer is a circular polarizer.

62. The reflection type liquid crystal display device according to Claim 61, wherein said circular polarizer comprises a linear polarizer and a λ/4 plate wavelength phase contrast plate.

63. The reflection type liquid crystal display device according to any one of Claim 59 to Claim 62, wherein an optical element to improve directivity of light is disposed in said light guiding plate.

64. The reflection type liquid crystal display device according to Claim 63, wherein said optical element to improve the directivity of light is disposed between said light source and said light guiding plate, and said light guiding plate and said optical element to improve the directivity of light are disposed optically separated from each other.

65. An illumination device comprising:

a light guiding plate;

a light source which is disposed on a side face of said light guiding plate;

a low refractive index layer which is formed on the

surface of said light guiding plate; and

a transparent conductive film which is disposed on said low refractive index layer at the opposite side from said light guiding plate.

66. An illumination device comprising:

a light guiding plate;

a light source which is disposed on a side face of said light guiding plate;

a transparent conductive film which is formed on the surface of said light guiding plate; and

a light absorption layer which is disposed between said light guiding plate and said transparent conductive film and absorbs light in a specific wavelength band.

67. An illumination device comprising:

a light guiding plate;

a light source which is disposed on a side face of said light guiding plate;

a low refractive index layer which is formed on the surface of said light guiding plate;

a light absorption layer which is formed on said low refractive index layer at the opposite side from said light guiding plate, and absorbs light in a specific wavelength band; and

a transparent conductive film which is formed on said light absorption layer at the opposite side from said light

guiding plate.

68. The illumination device according to any one of Claim 66 to Claim 67, wherein said transparent conductive film is a film containing InO and SnOx, and the absorption factor of said light absorption layer is adjusted such that R, G and B are almost the same when combined with the absorption of said transparent conductive film.

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69. The illumination device according to Claim 65 or Claim 67, wherein said low refractive index layer and said transparent conductive film are formed on said light guiding plate side face of the transparent element disposed at the observer side of said light guiding plate, and said low refractive index layer and said light guiding plate contact each other at least in a part of the area.

70. The illumination device according to Claim 67 or Claim 68, wherein said low refractive index layer, said transparent conductive film, and said light absorption layer are formed on said light guiding plate side face of the transparent element which is disposed at the observer side of said light guiding plate, and said low refractive index layer and said light guiding plate contact each other at least in a part of the area.

71. An illumination device comprising:

a light guiding plate which comprises a plurality of convex parts which include a first inclined face which rises from a flat plane at a first angle or is in parallel with the flat plane, and a second inclined face which is formed adjacent to said first inclined face and falls at a second angle larger than said first angle;

a light source disposed on a side face of said light guiding plate;

a transparent element which is disposed on said light guiding plate contacting at least one area; and

a light shielding layer which is disposed near said second inclined face of said light guiding plate.

72. The illumination device according to Claim 71, further comprising a low refractive index layer which is disposed between said transparent element and said light guiding plate without contacting either.

73. The illumination device according to any one of Claim 67 to Claim 72, wherein an optical element to improve a directivity of light is disposed in said light guiding plate.

74. The illumination device according to Claim 73, wherein said optical element to improve the directivity of light is disposed between said light source and said light guiding plate, and said light guiding plate and said optical element to improve the directivity of light are disposed

optically separated from each other.